MAR 1952 51-4C

CLASSIFICATION S-E-C-R-E-T [redacted]

CENTRAL INTELLIGENCE AGENCY

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COUNTRY	USSR		
25X1 SUBJECT	Scientific - Chemistry, oxidants, propellants		
HOW PUBLISHED	Monthly periodicals, book	DATE DIST.	9 Apr 1953
WHERE PUBLISHED	Moscow/Leningrad	NO. OF PAGES	3
DATE PUBLISHED	1935 - 1951		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

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RECENT USSR WORK IN CONNECTION WITH HYDROGEN PEROXIDE AND PERACIDS

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Overt Soviet scientific literature is being continuously exploited to provide information concerning the production and utilization of hydrogen peroxide and other peroxides which may have application as oxidants in the field of rocket propellants. No specific information on plants producing these substances or on production figures can be obtained from current periodicals, although some is available from older Soviet publications. On the other hand, the material exploited provides indications as to trends and technological developments and can be used in conjunction with more specific older material to provide more detailed information than can be obtained on the basis of current published information alone.

As to the production of hydrogen peroxide, in 1935 hydrogen peroxide and peracid salts were evidently manufactured by either the Ugreshskiy Chemical Combine (in Moscow) or the Chernorechensk Chemical Combine in Dzerzhinsk, or both.(1) This is based on the statements concerning the State Institute of Applied Chemistry to the effect that the institute rendered technical assistance to industry in connection with the electrochemical production of perchlorates, persulfates, manganese dioxide, hydrogen peroxide, and other compounds having strong oxidizing properties, and that the above two plants, together with the Volkhovsk Aluminum Khimkombinat, are enterprises regularly served by the institute.

More recent publications have not provided such specific information, but two recent reports indicate new developments. The first concerns new work on the electrolytic oxidation of sulfates into persulfates, which are intermediate products in the manufacture of hydrogen peroxide. N. A. Izgaryshev and A. A. Petrova conducted an intensive investigation at the Moscow Technological Institute imeni D. I. Mendeleyev on the electrolytic oxidation of sulfates into persulfates, proving that the presence of the fluoride ion during the electrolysis increased the rate and efficiency of the process.(2)

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Another important new Soviet scientific development is the synthesis of two higher oxides of nitrogen and the synthesis for the first time of salts of pernitric acids by Prof V. I. Nikolayev and T. I Arnol'd ("Higher Oxides of Nitrogen and Synthesis of Salts of Pernitric Acid," 00-W-16941). Salts of pernitric acids (silver pernitrate being stable up to a temperature of +68°) have a potential application as rocket fuel oxidants.

From the point of view of the production and catalytic activation of hydrogen peroxide, as well as of the use of salts of peracids themselves as rocket fuel oxidants, four reports by G. A. Bogdanov, identified in 1947 with Moscow State University, Institute of Chemistry, may be of interest in connection with potential application. These reports all give results of investigations on the catalysis of the decomposition of hydrogen peroxide by normal salts of peracids: sodium permolybdate + ferric sulfate (FDD Per Abs 14T99); potassium pertungstate (FDD Per Abs 170T18); sodium pertungstate (3), and potassium perchromate (4). Bogdanov also isolated the intermediate products of these reactions -- compounds with an even higher oxygen content and therefore more powerful oxidants -- and studied their decomposition. It is conceivable that compounds of the type listed above, being comparatively insoluble, may be used as intermediates in a new method for the convenient preparation of concentrated hydrogen peroxide.

Considerable other research has been devoted to the investigation of catalysts for the decomposition of hydrogen peroxide, the emphasis being placed on finding the most efficient catalyst. Among the catalysts on which work has been done are cobalt, nickel, and copper oxides, investigated by A. Ya. Zvorykin and F. M. Perel'man (5); platinum by N. I. Kobozev and N. A. Reshetovskaya, Laboratory of Catalysis and Gas Electrochemistry, Moscow State University (FDD Per Abs 57/49T19), bismuth-tin and antimony-cadmium alloys by V. A. Shushunov and K. G. Fedyakova, Gor'kiy State University, Scientific Research Institute of Chemistry (FDD Per Abs 67/49T13).

An important potential development in the field of propellant utilization is suggested by a Soviet professor, M. B. Ravich, in his recent book Besplamennoye Poverkhnostnoye Goreniye (Flameless Surface Combustion), Press of Academy of Sciences USSR, 1949 (see "Information from 'Flameless Surface Combustion' by M. B. Ravich," 00-W-17900). Flameless surface combustion is a procedure whereby the combustion of a mixture of a gas and air, for instance, takes place along the walls of a chamber, being catalyzed by a substance imbedded in the chamber walls. It is an extremely efficient combustion method. Professor Ravich notes that the German rocket plane Me-163 was propelled by a mixture of hydrogen peroxide and methyl alcohol with potassium permanganate added as a catalyst. He suggests that in this connection the catalytic activation of the walls of combustion chambers and of ignition devices should be applied.

Ravich credits the All-Union Scientific Research Institute of Fuel Utilization (formerly the Ural Branch of the All-Union Heat Technology Institute) with a large share in the development of flameless surface combustion for industrial furnaces. It is conceivable, in the light of the remarks made above, that this institute could conduct research on flameless surface combustion for other purposes.

Direct evidence that Soviet scientists have done work on the combustion of hydrogen peroxide and methyl alcohol is furnished by the report of R. Kh. Kurbangaliyev (6) on work carried out under the auspices of the Institute of Chemical Physics, Academy of Sciences USSR in Moscow, which gives results of experiments on persistent detonation of hydrogen peroxide-methyl alcohol and chloric acid-ethyl alcohol mixtures.

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1. Nauchno-Issledevatel'skiye Instituty Tyazheloy Promyshlennosti (Scientific Research Institutes of Heavy Industry), edited by A. A. Armand, Moscow/ Leningrad, 1935, pp 113, 114

2. Zhurnal Fizicheskoy Khimii, Vol XXIV, No 7, 1950, pp 881-887

3. Ibid., Vol XXV, No 1, 1951, pp 49-60

4. Ibid., Vol XXV, No 1, 1951, pp 61-70

5. Ibid., Vol XX, No 10, 1946, pp 1095-1101

6. Ibid., Vol XXII, No 1, 1948, pp 49-51

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